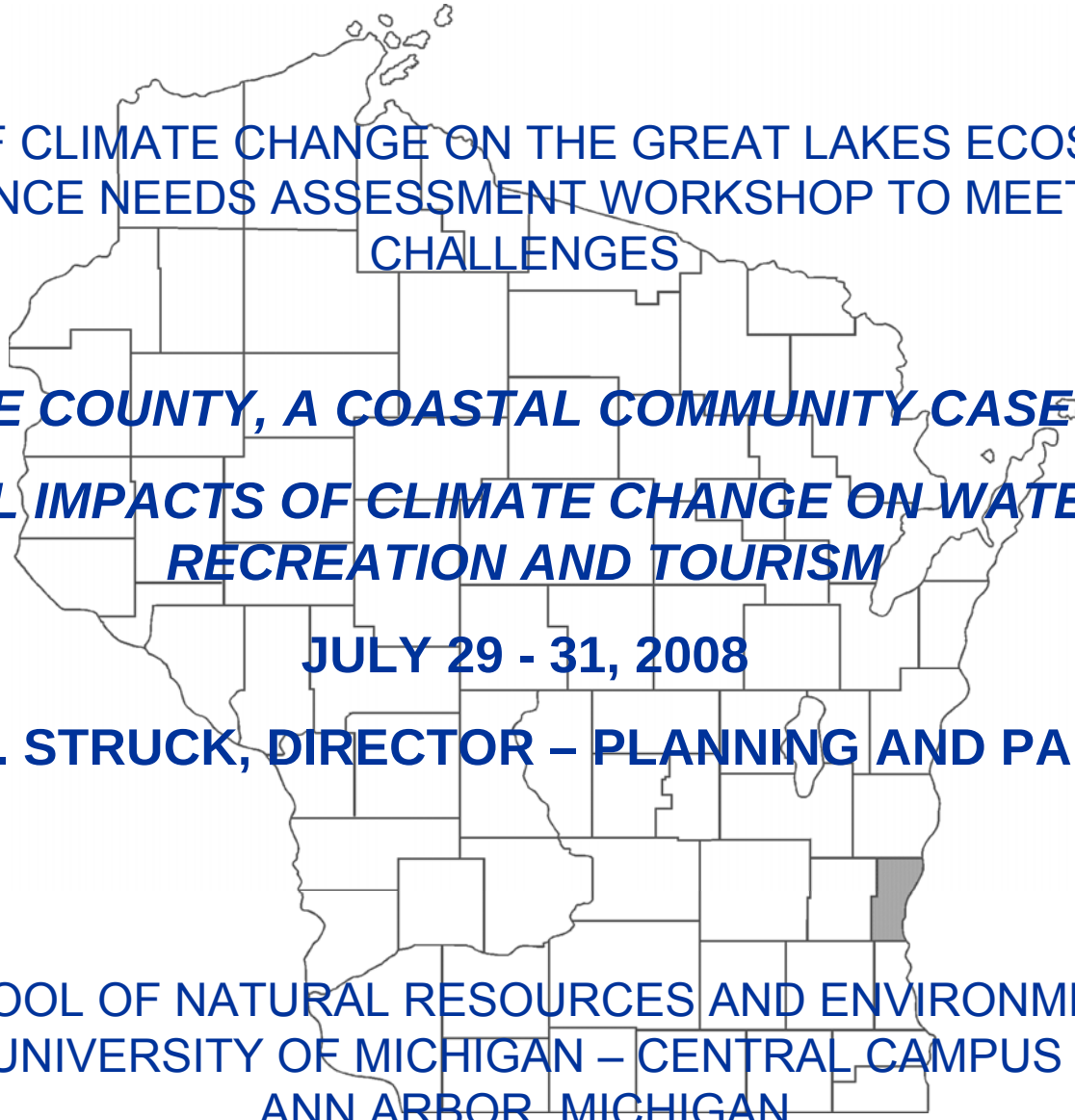
OZAUKEE COUNTY
PLANNING AND PARKS DEPARTMENT



IMPACT OF CLIMATE CHANGE ON THE GREAT LAKES ECOSYSTEM –
A NOAA SCIENCE NEEDS ASSESSMENT WORKSHOP TO MEET EMERGING CHALLENGES

OZAUKEE COUNTY, A COASTAL COMMUNITY CASE STUDY:

POTENTIAL IMPACTS OF CLIMATE CHANGE ON WATER-BASED RECREATION AND TOURISM

JULY 29 - 31, 2008

ANDREW T. STRUCK, DIRECTOR – PLANNING AND PARKS DEPT

SCHOOL OF NATURAL RESOURCES AND ENVIRONMENT
UNIVERSITY OF MICHIGAN – CENTRAL CAMPUS
ANN ARBOR, MICHIGAN

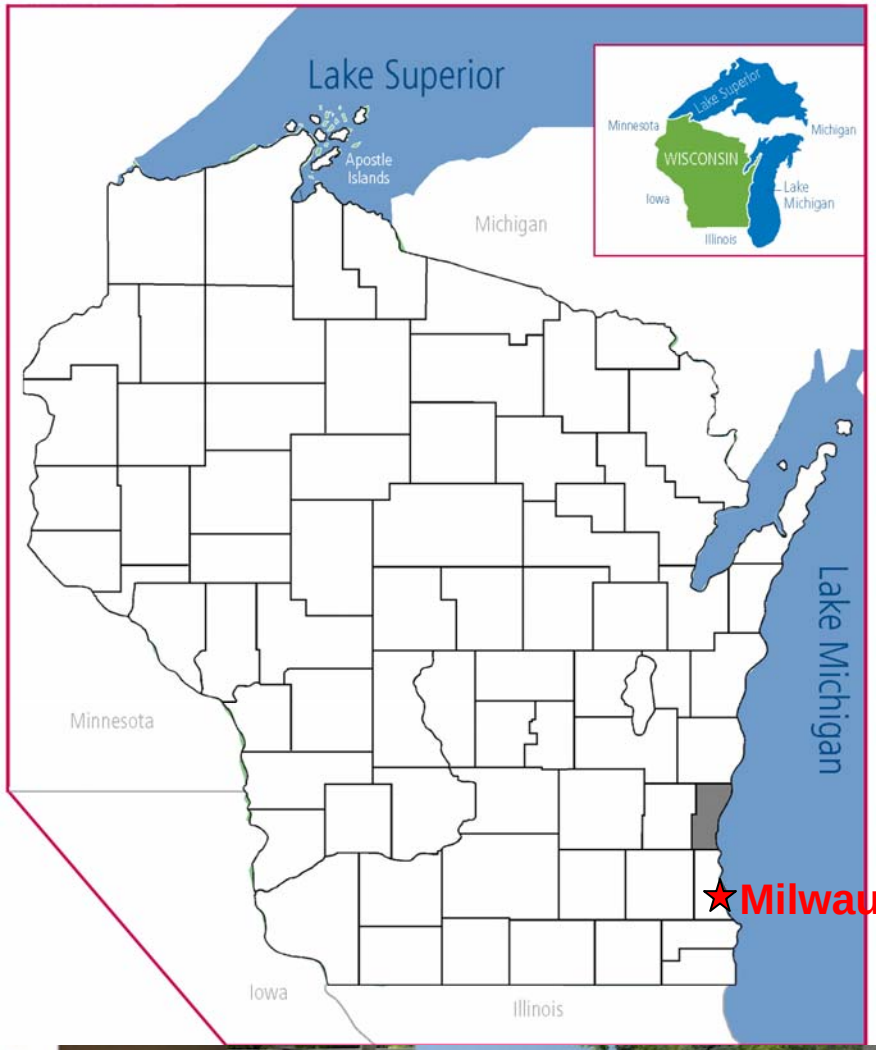
OZAUKEE COUNTY
PLANNING AND PARKS DEPARTMENT

OZAUKEE COUNTY, A COASTAL COMMUNITY CASE STUDY:

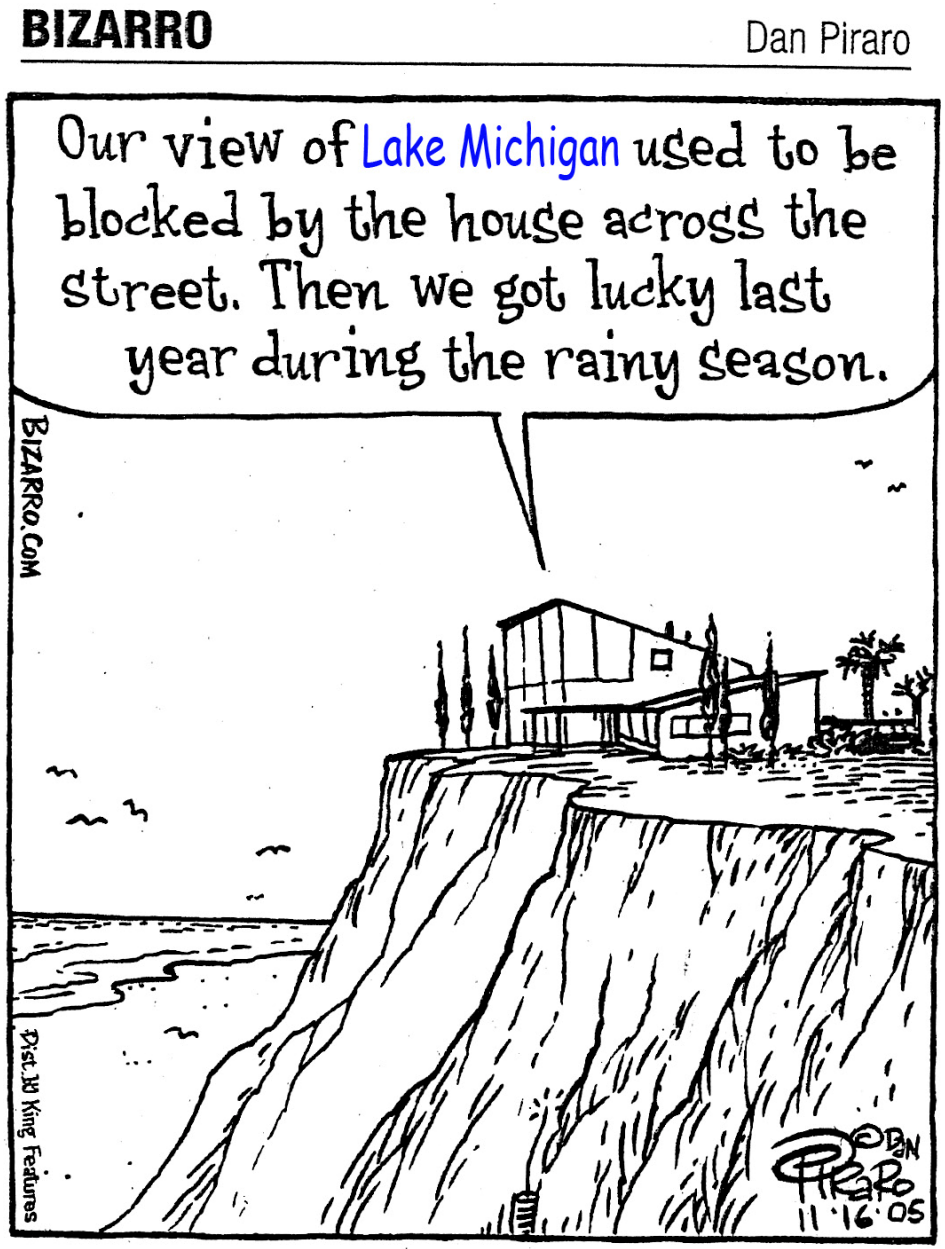
POTENTIAL IMPACTS OF CLIMATE CHANGE ON WATER-BASED RECREATION AND TOURISM

- **PHYSICAL ENVIRONMENT – COASTAL EROSION**
- **SEASONAL PRECIPITATION AND FREQUENCY OF RAINFALL – FLOODING**
- **WATER QUANTITY – LAKE LEVELS – HARBOR ACCESS / BOATING**
- **WATER QUALITY – STORMWATER INPUTS**
- **HUMAN HEALTH – BEACH CLOSURES AND ALGAL BLOOMS**
- **FISH RECRUITMENT AND PRODUCTIVITY – CHARTER FISHING INDUSTRY AND FISH IMPEDIMENTS**

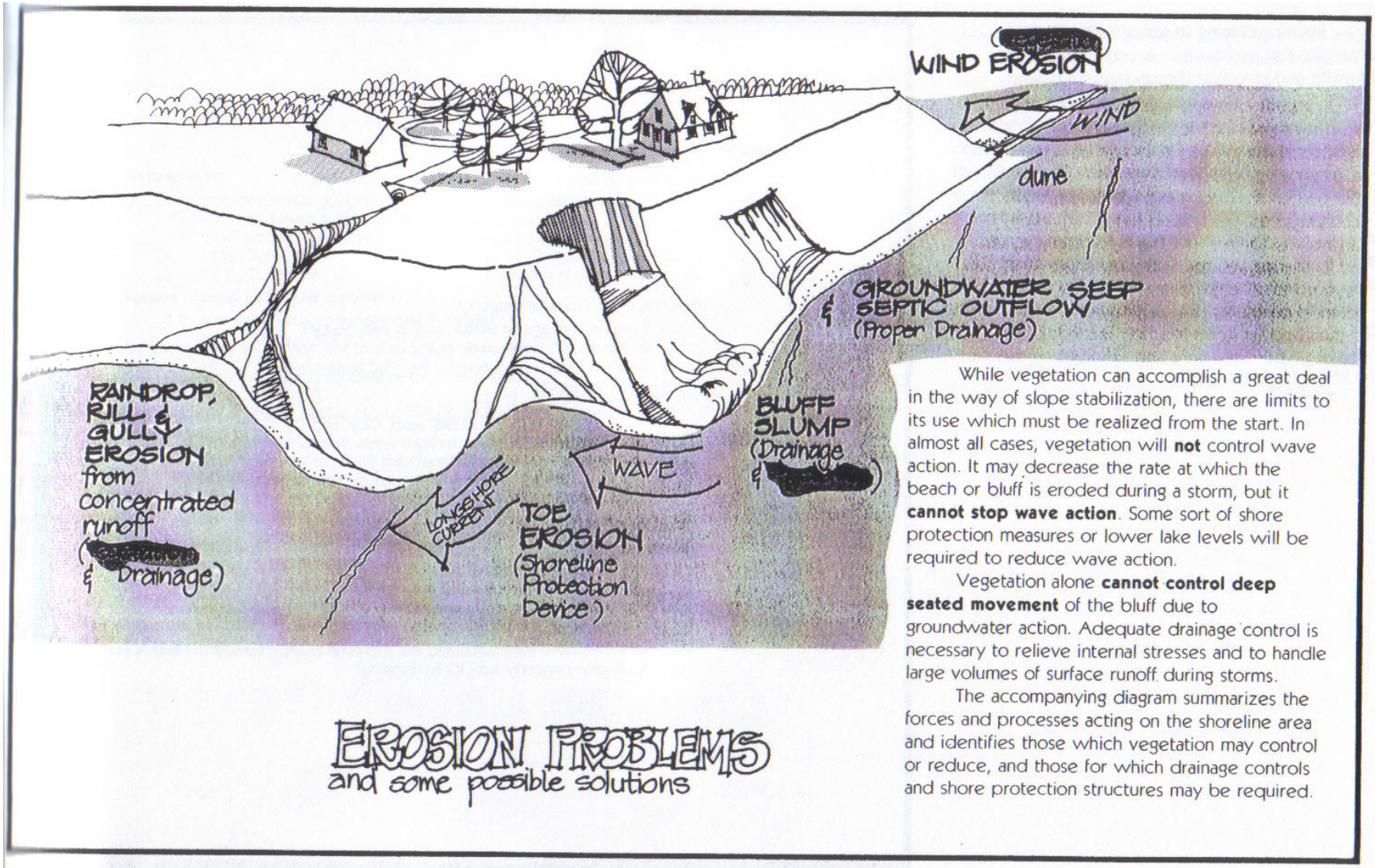
PHYSICAL ENVIRONMENT



PHYSICAL ENVIRONMENT – COASTAL EROSION



PHYSICAL ENVIRONMENT – COASTAL EROSION



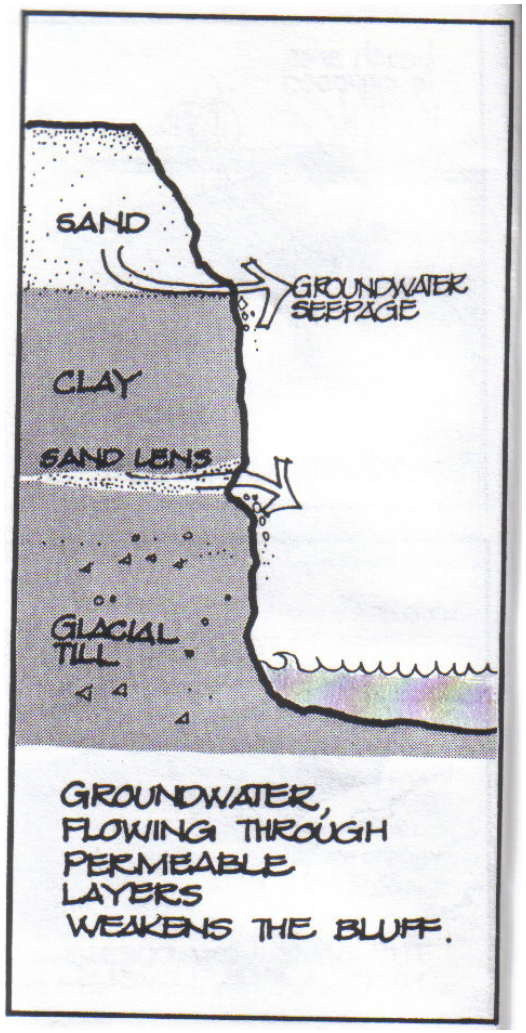
EROSION PROBLEMS
and some possible solutions

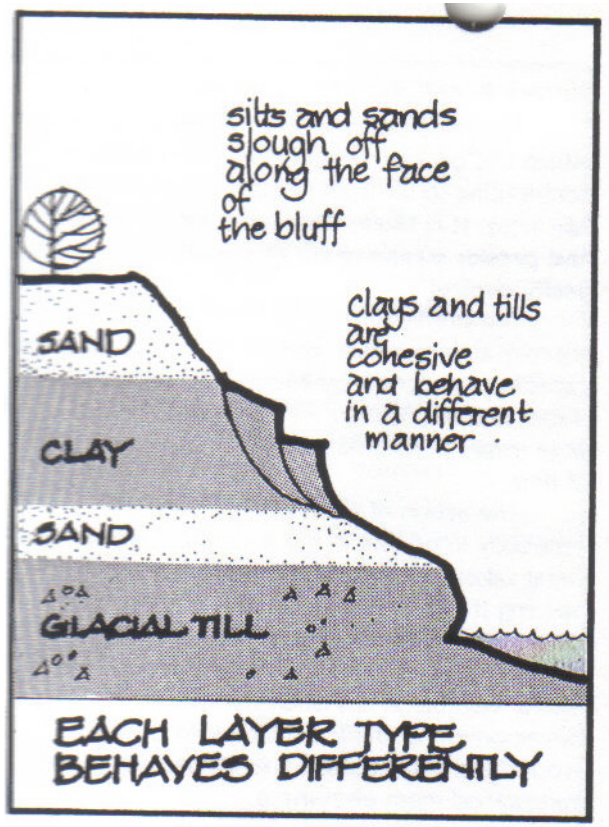
While vegetation can accomplish a great deal in the way of slope stabilization, there are limits to its use which must be realized from the start. In almost all cases, vegetation will **not** control wave action. It may decrease the rate at which the beach or bluff is eroded during a storm, but it **cannot stop wave action**. Some sort of shore protection measures or lower lake levels will be required to reduce wave action.

Vegetation alone **cannot control deep seated movement** of the bluff due to groundwater action. Adequate drainage control is necessary to relieve internal stresses and to handle large volumes of surface runoff during storms.

The accompanying diagram summarizes the forces and processes acting on the shoreline area and identifies those which vegetation may control or reduce, and those for which drainage controls and shore protection structures may be required.

PHYSICAL ENVIRONMENT – COASTAL EROSION



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3/20/2006

2/22/2006

1/27/2006

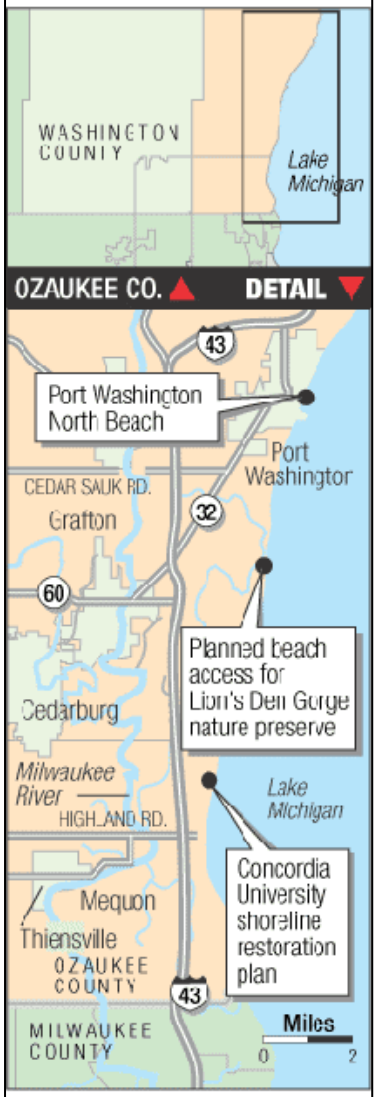
3/20/2006

3/20/2006

OZAUKEE COUNTY

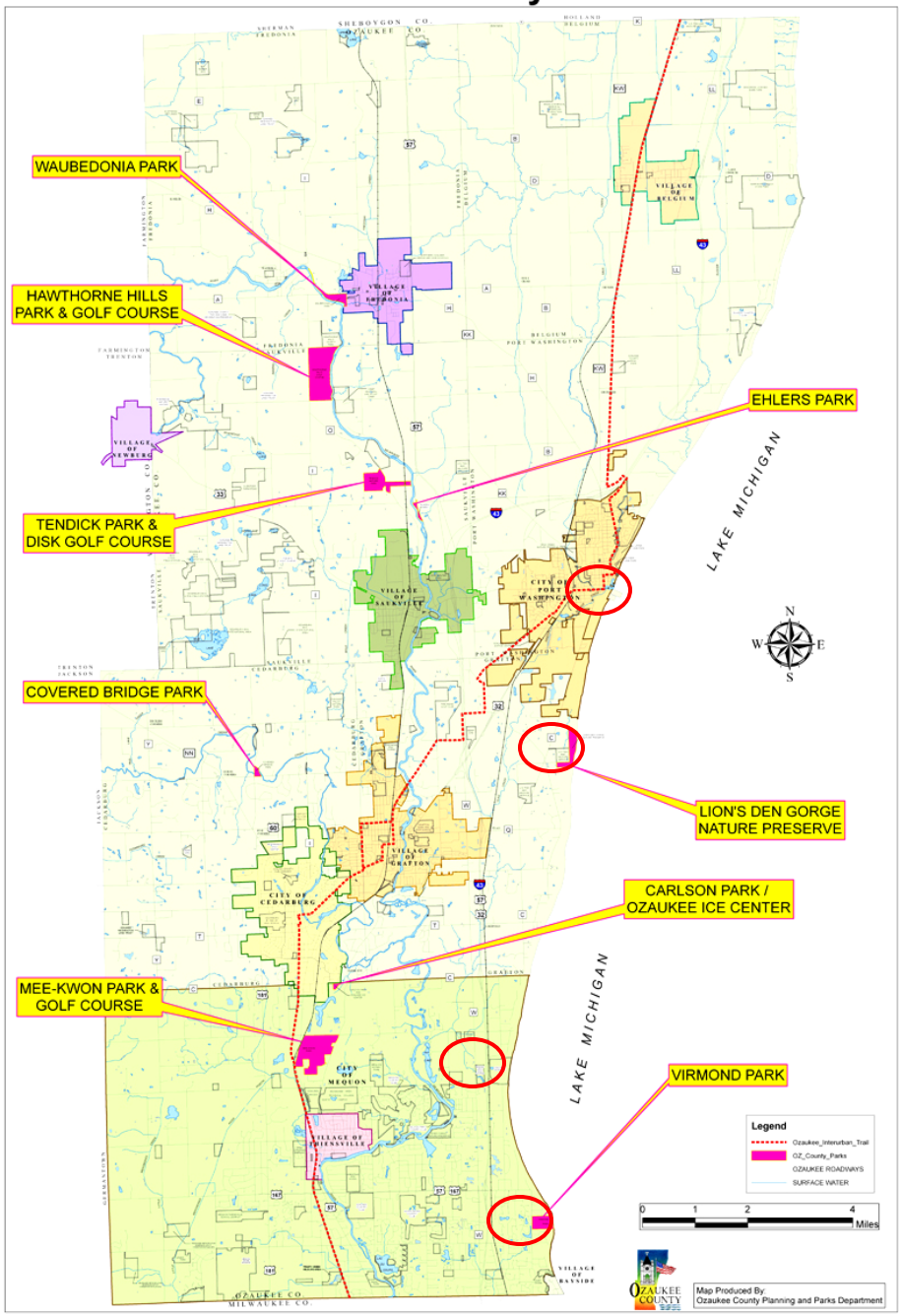
LAKE ACCESS
GETTING TO THE WATER

Efforts are underway to improve public access to the Lake Michigan shoreline at three locations in Ozaukee County. At least one of the projects could be completed by winter and another project might be completed as early as summer 2006.



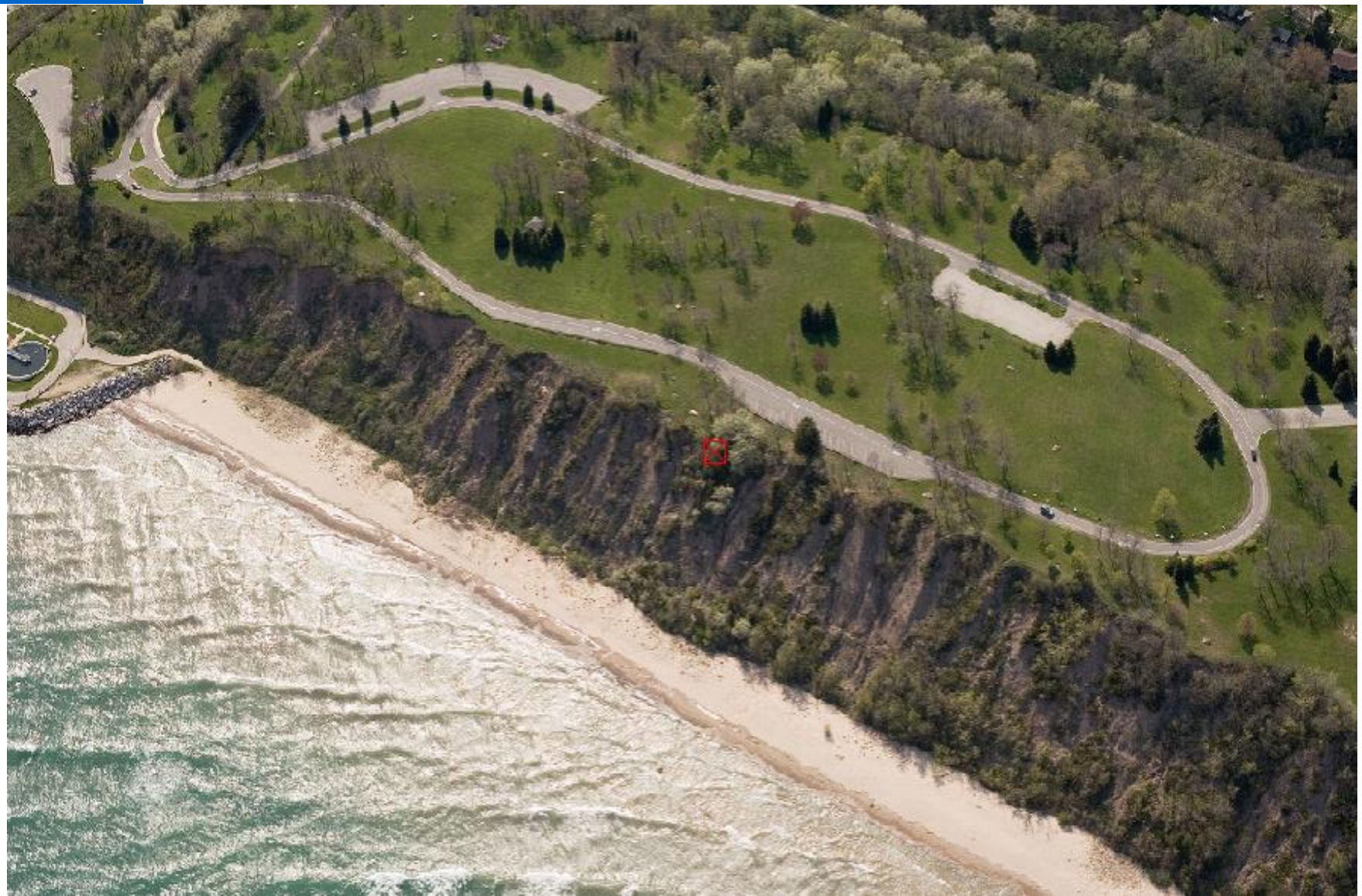
Journal Sentinel

Ozaukee County Parks



PHYSICAL ENVIRONMENT – COASTAL EROSION

UPPER LAKE PARK BEACH – PORT WASHINGTON



PHYSICAL ENVIRONMENT – COASTAL EROSION

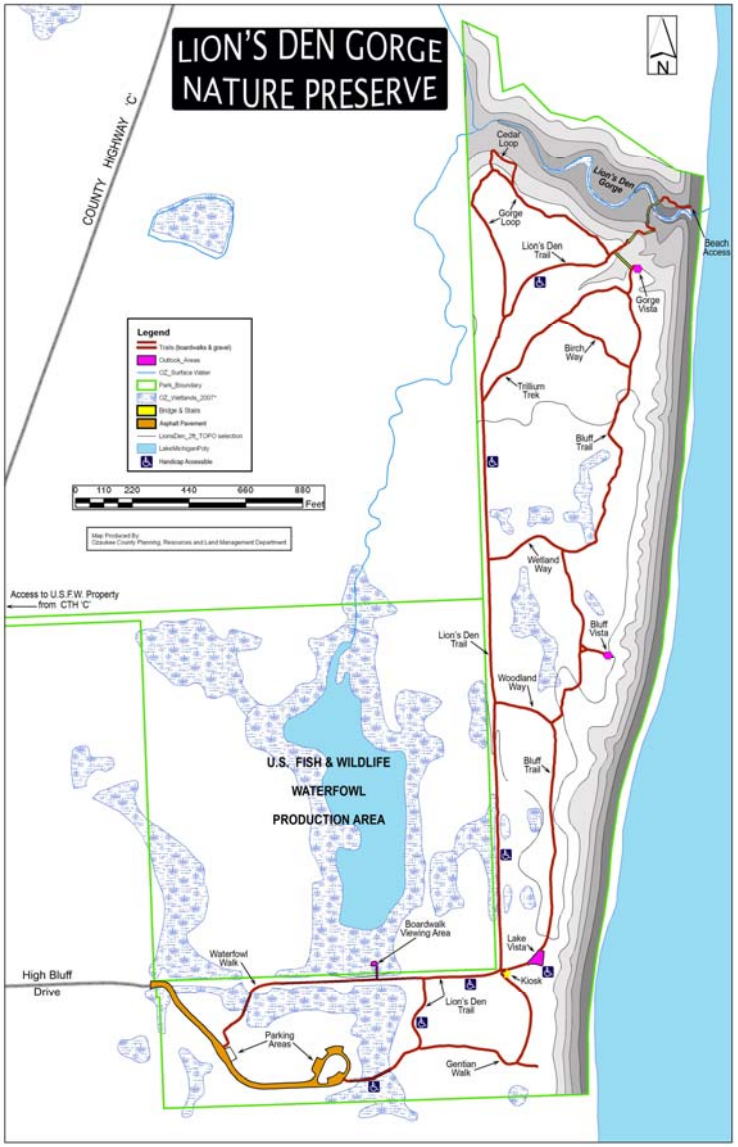
VIRMOND PARK – OZAUKEE COUNTY

PHYSICAL ENVIRONMENT – COASTAL EROSION

LION'S DEN GORGE – OZAUKEE COUNTY

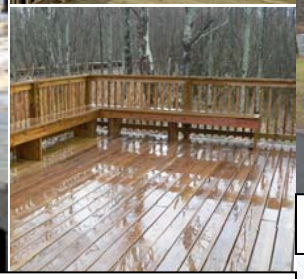
PHYSICAL ENVIRONMENT – COASTAL EROSION

LION'S DEN GORGE – OZAUKEE COUNTY



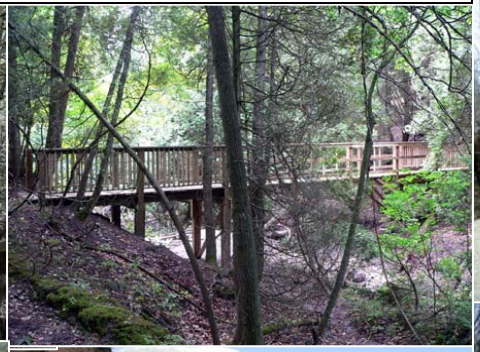
PHYSICAL ENVIRONMENT – COASTAL EROSION

LION'S DEN GORGE – OZAUKEE COUNTY



Boardwalk / Wetland Viewing Platform

Grass *GeoBlock* Permeable Parking Lot



Stairs / Bridge / Lake Access

Trails & Lake Michigan Bluff Viewing Area – Handicap Accessible

THURSDAY
JUNE 29, 2006
Ozaukee County
Stay in touch 24/7 gmtoday.com
75¢
Volume 124 Number 51 · 2 Sections 20 Pages

NEWS GRAPHIC
OZAUKEE COUNTY'S NEWSPAPER SINCE 1883

Making the grade

Photo by Deb Kranitz

Crews continue to work on the $8 million bluff stabilization project at Concordia University. Officials expect it to be completed by the time students return to the campus this fall.

'We've made terrific progress'

By Ann Brownfield
News Graphic Correspondent

Mequon — The construction phase of an $8 million bluff stabi-

tion including wild flowers and prairie grass remains to be done this fall.

Concordia University students will have limited access to the

one hour before sunrise until 1 hour after sunset. Permits will be issued by the University Relations office, according to Duane Hilgen-

dorf. Concordia University vice

Photo by Deb Kranitz

The bluff project will include coastal wetland areas fed by lake water and perched wetland areas fed by groundwater seeps which will be channeled to them.

Bluff: Completion eyed for fall

Continued from Page 1

tion we are interested in the teaching and learning opportunities (that will arise from this project). The university has added a graduate program in environmental education and a bachelor's degree in environmental studies," he added.

Both new programs will make use of the opportunities for study afforded by the project.

Both Ferry and Hilgendorf are also pleased to be able to provide an important community resource, particularly to local schools.

"We envision grade school students able to learn from our students, who will be the resident experts, about aquatics, wetlands and ecosystems," Ferry said.

In addition, he noted that the property lies within major migratory patterns for various species of birds and butterflies, making it an attractive site for study by local residents. "This is really the first time we've been able to take advantage of our location and our half-mile of lakefront property and the recreational, as well as educational, opportunities," he added.

Ferry acknowledged that many years of planning have gone into the project.

"Our board made an effort in 2000 to address the bluff and the erosion as a priority capital item," he explained. "It was daunting at that time to consider all the permits, engineering plans, property acquisition and raising the funds to cover the project."

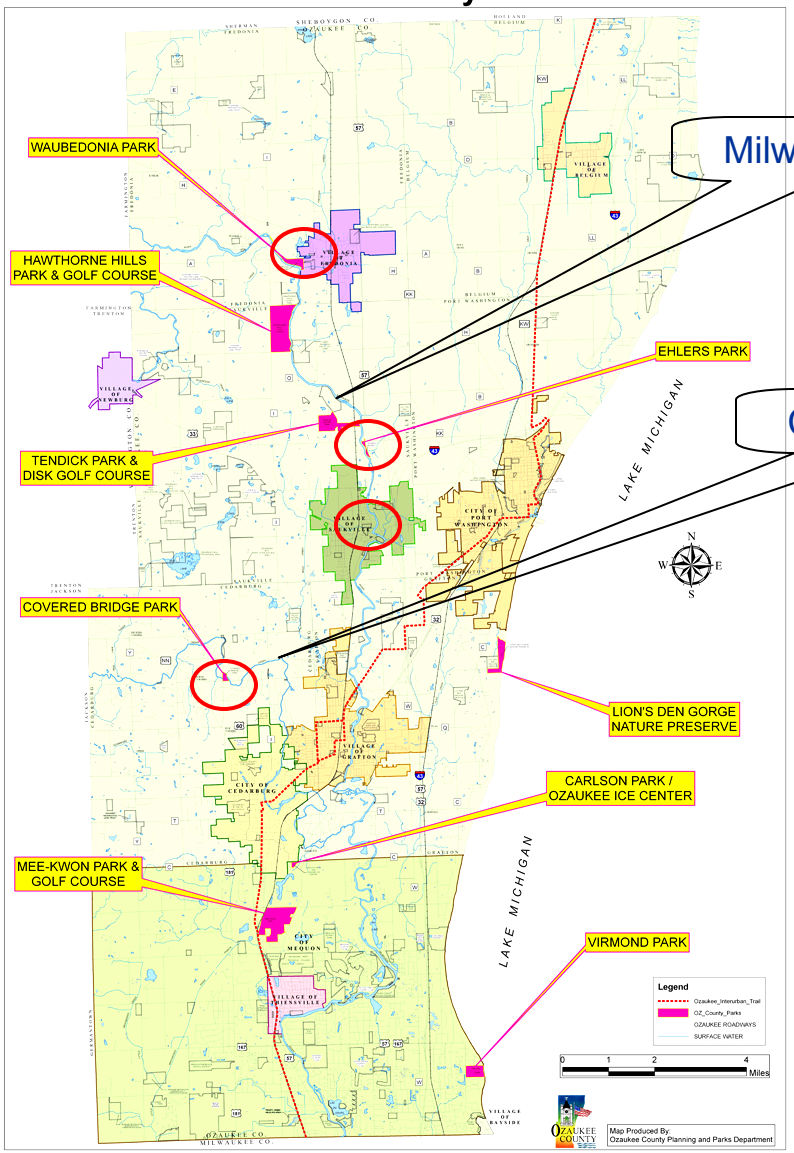
To date, Concordia has been able to secure enough funding, much of it through donations, to cover the cost of the bluff stabilization project, characterized by Ferry as only a part of a much broader capital plan for the campus.

Acreage acquired by the university just across Highland Road to the south of the campus has been used as a staging ground for equipment and materials for the project, and is part of the university's long term plan, but will not be utilized in the immediate future once the bluff stabilization project is complete, he said.

The university is also seeking donations to fund an Environmental Education Center to house classrooms, lecture facilities and state-of-the-art laboratories.

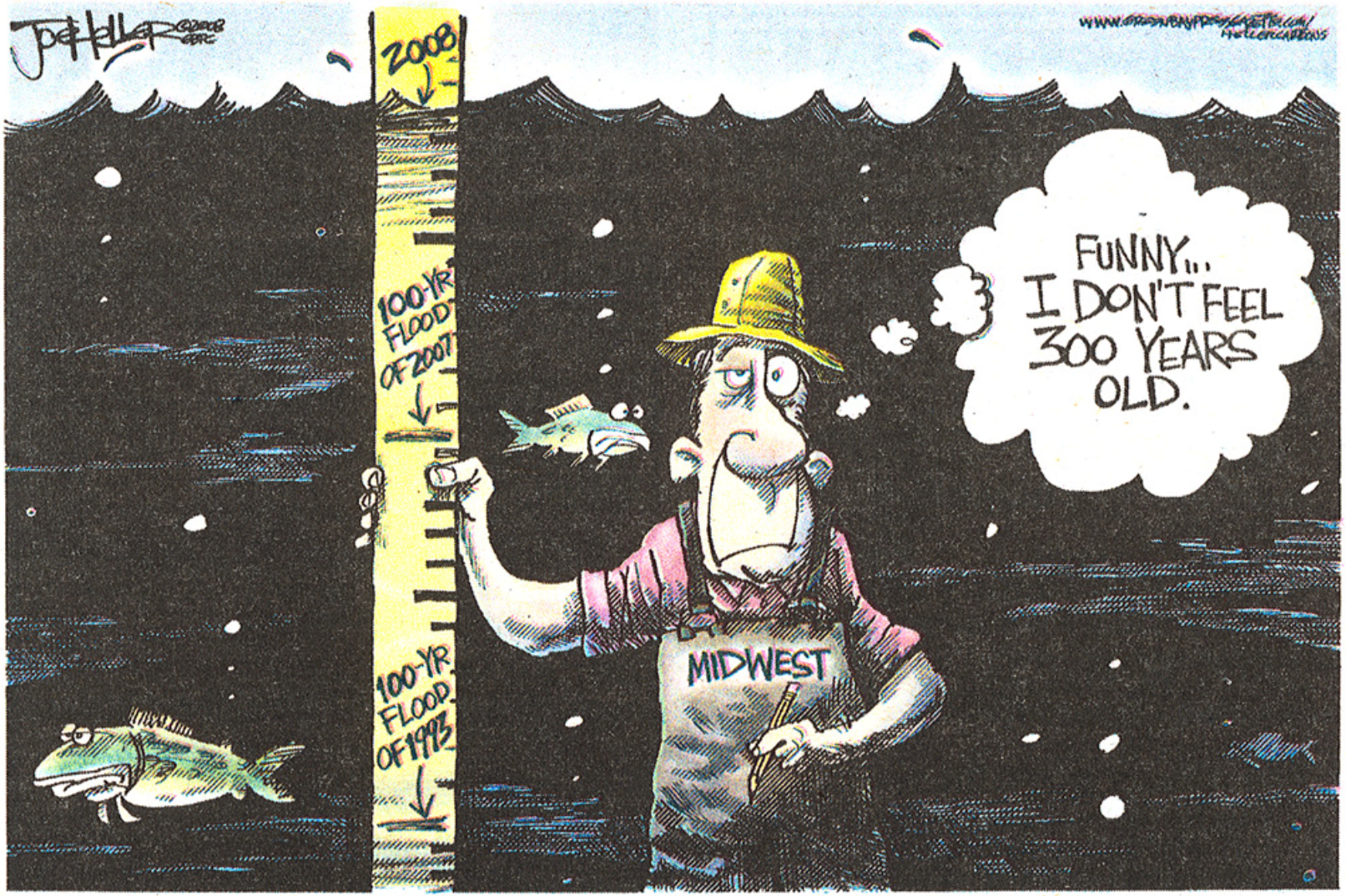
SEASONAL PRECIPITATION AND FREQUENCY OF RAINFALL – FLOODING

Ozaukee County Parks



SEASONAL PRECIPITATION AND FREQUENCY OF RAINFALL – FLOODING

OZAUKEE PRESS THURSDAY, JUNE 26, 2008 3A



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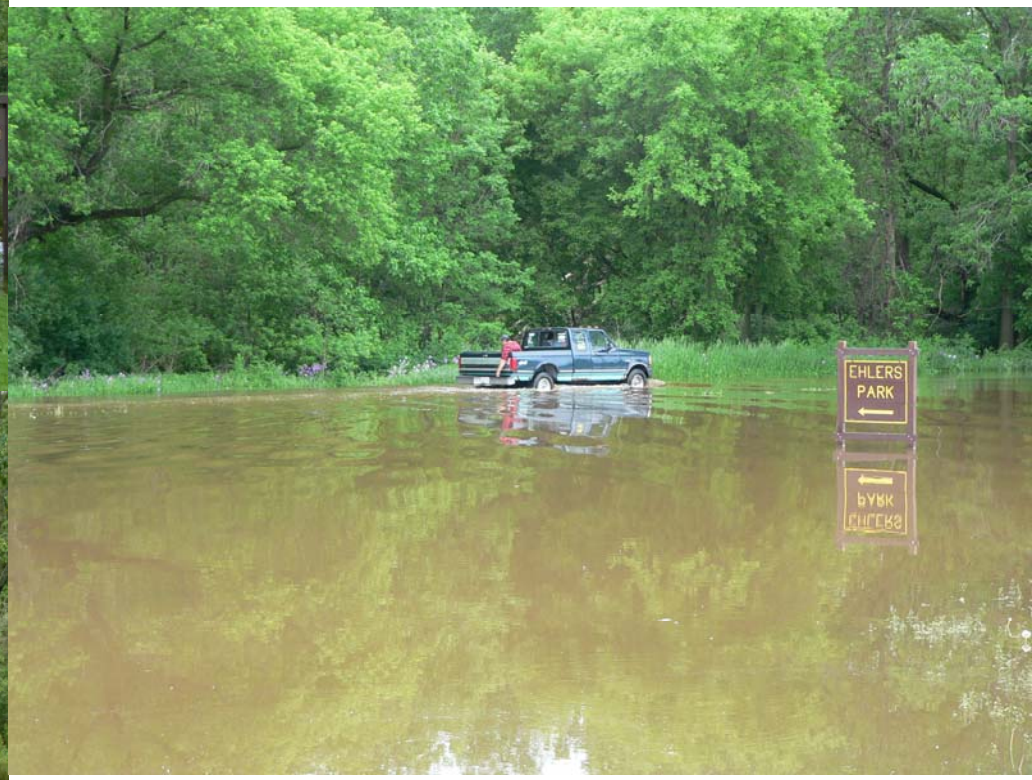


SEASONAL PRECIPITATION AND FREQUENCY OF RAINFALL – FLOODING

SEASONAL PRECIPITATION AND FREQUENCY OF RAINFALL – FLOODING

SEASONAL PRECIPITATION AND FREQUENCY OF RAINFALL – FLOODING


BEFORE

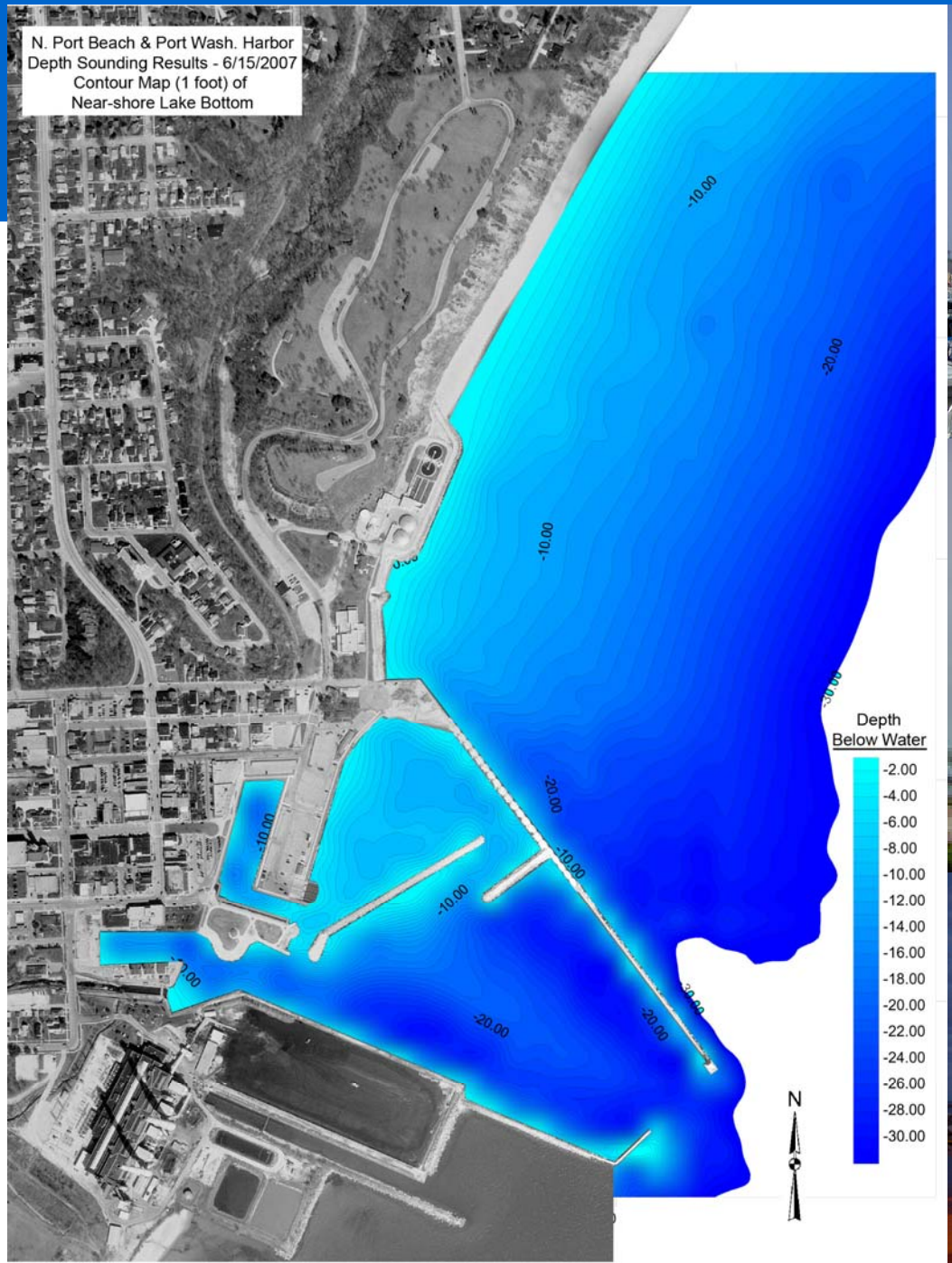

AFTER

WATER QUANTITY – LAKE LEVELS AND HARBOR ACCESS / BOATING / FISHING

PORT WASHINGTON HARBOR

OZAUKEE COUNTY

OZAUKEE COUNTY



WATER QUANTITY – LAKE LEVELS AND HARBOR ACCESS / BOATING / FISHING

IMPACT OF THE CHARTER FISHING INDUSTRY – PORT WASHINGTON

- 31 Total Charter Boats
- Dock fees paid to City Marina by Charter Boat owners $68,850 / year
- Charter fishing season spans five months – May through September
- 2,588 Trips and 12,842 People Fishing in 2007
- Approximately 42% were non-resident in 2007
- The total number of hotel room rentals - approximately 2,400 annually
- Impact to area restaurants is approximately $400,000 annually
- Impact to other area business – the Charter Fleet purchased 49,294 gallons of fuel ($166,558) in 2007

Source: Port Washington Charter Association Economic Impact Study (2008)

Comprehensive Sanitary Survey of Upper Lake Park Beach

Summer 2007
(May 28th – September 3rd)

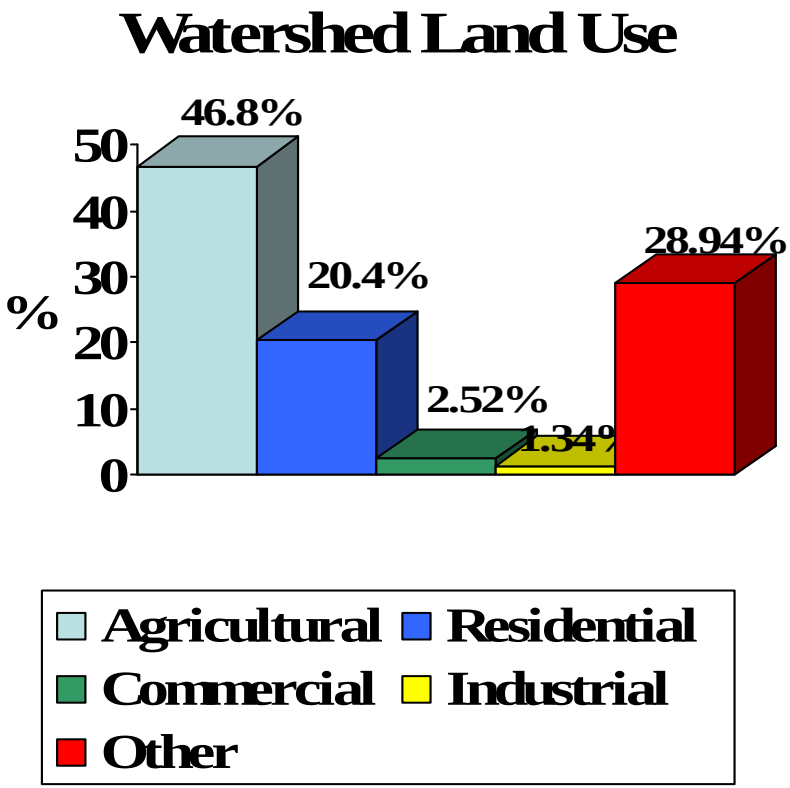
City of Port Washington
Ozaukee County Planning and Parks
Ozaukee County Public Health Department

Valley Creek Outfall

Valley Creek Outfall

- Average Flows
  - June 0.377 MGD
  - July 1.10 MGD
  - August 4.21 MGD
- Peak Flow
  - August 22nd - 23rd
  - 27.2 MGD

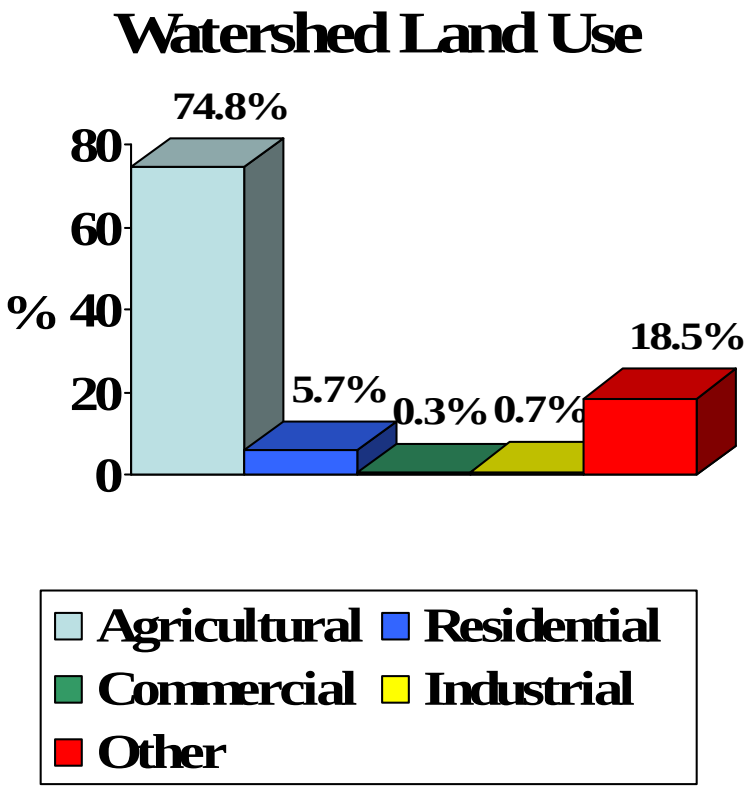
MGD = million gal per day



Sauk Creek

Sauk Creek

- Average Flow
  - June 3.19 MGD
  - July 10.43 MGD
  - August 34.92 MGD
- Peak Flow
  - August 20th - 21st
  - 168.4 MGD

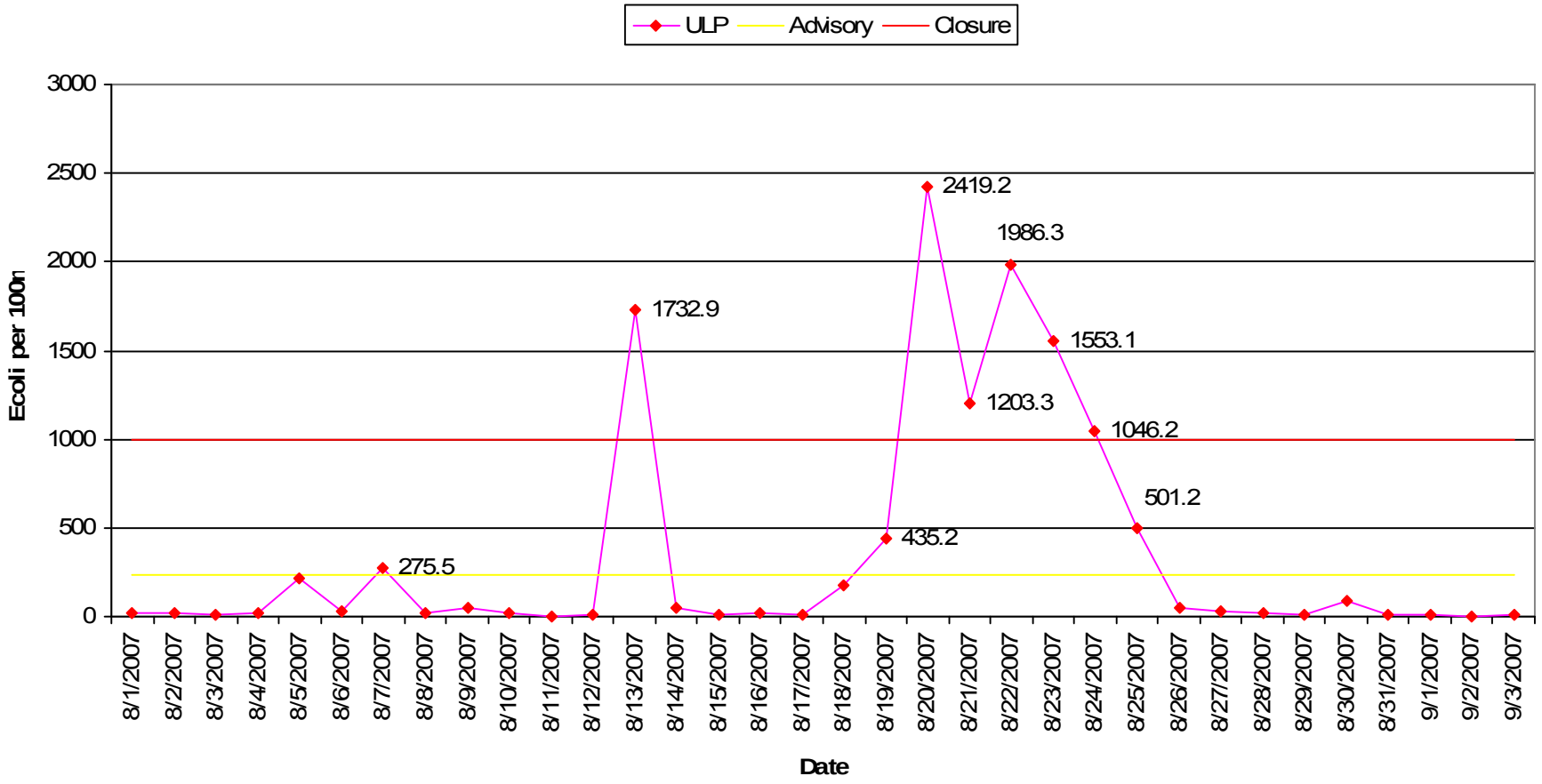


HUMAN HEALTH – BEACH CLOSURES AND ALGAL BLOOMS

Advisory / Yellow
≥ 235 < 1000CFU /100mL

Closure / Red
≥1000 CFU / 100mL

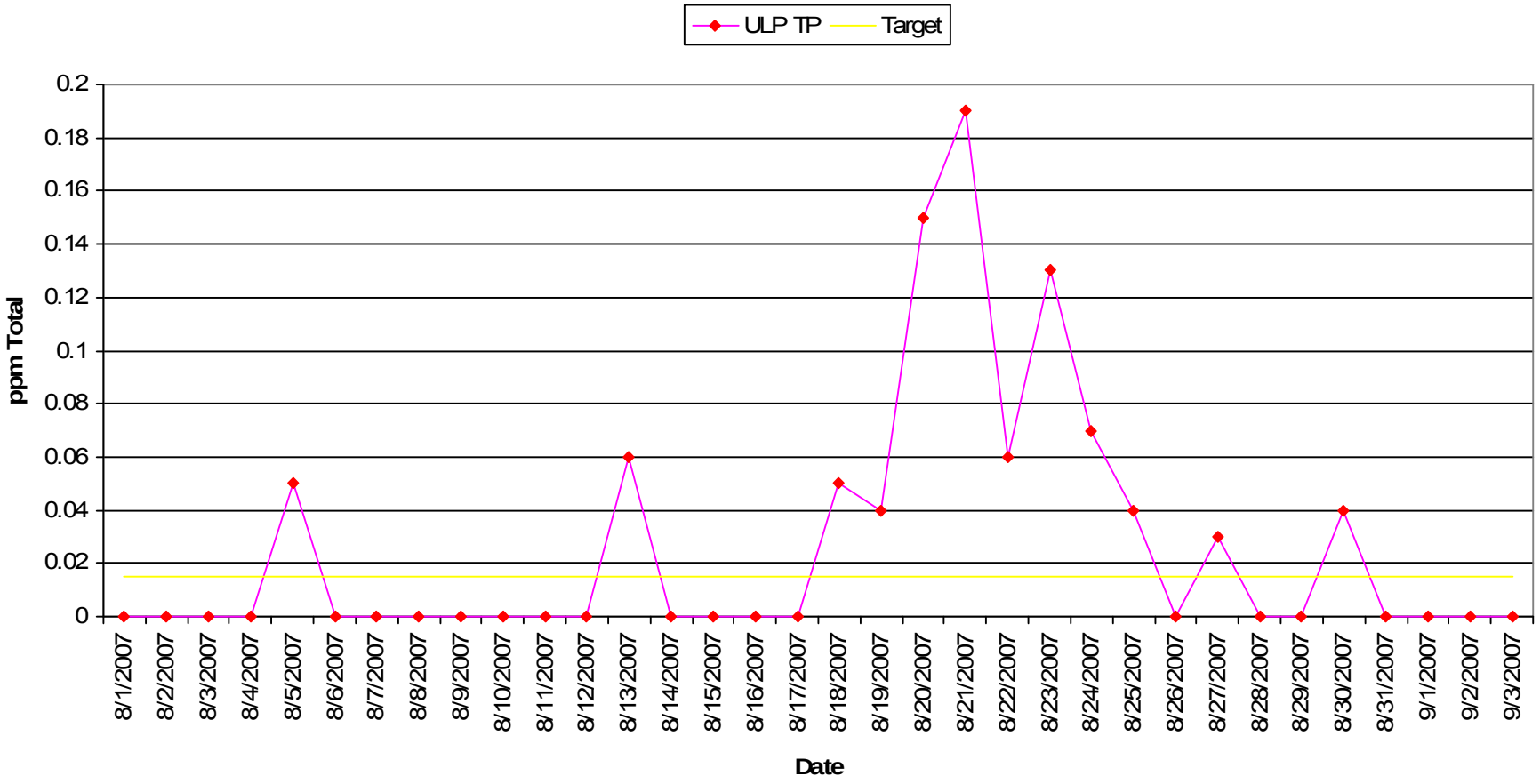
Aug-Sept E.coli Levels Upper Lake Park



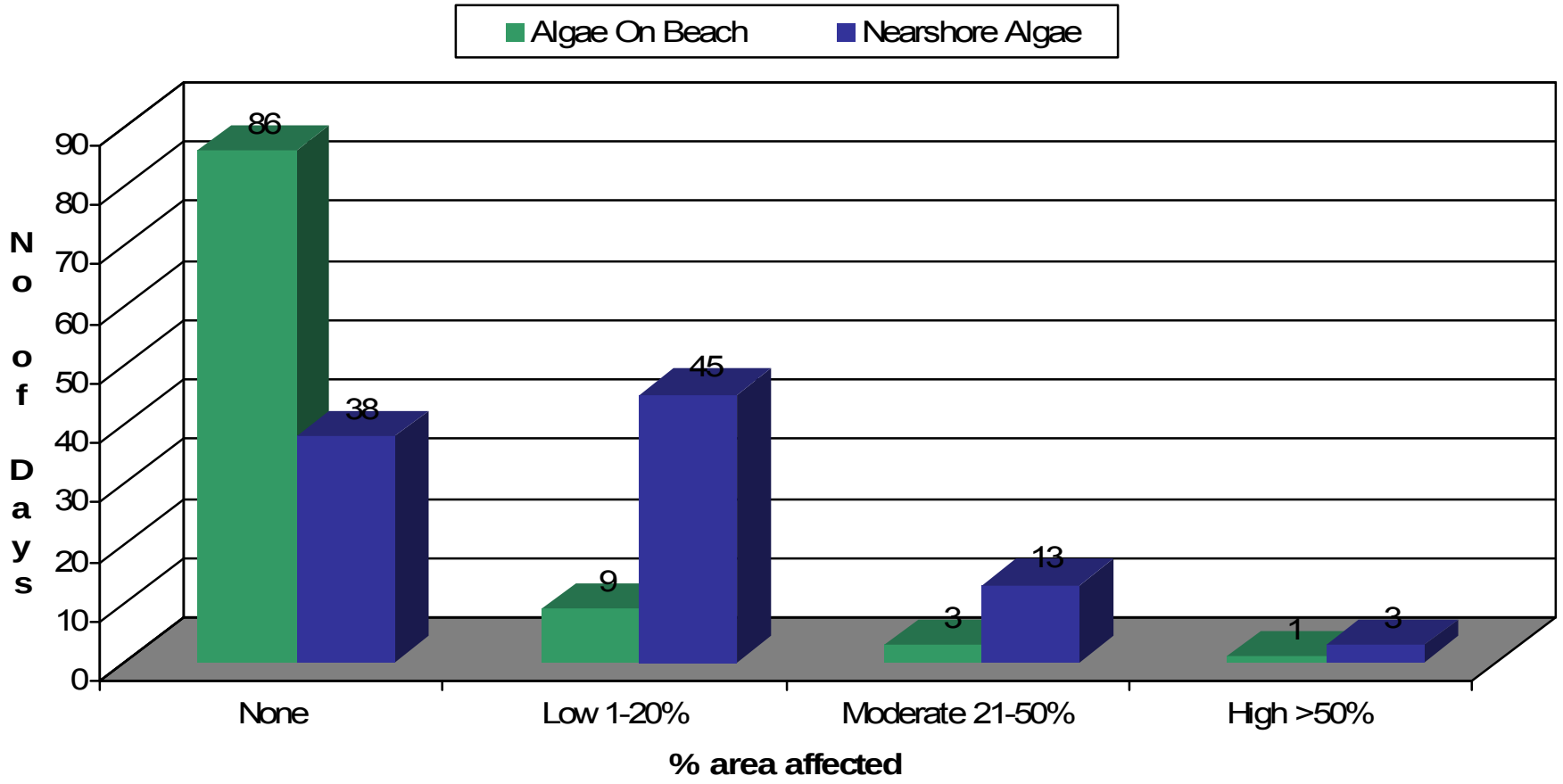
Upper Lake Park 2007 Advisory Summary

- 12 closure advisories
  - All closures were rain related
    - Aug 20th –Aug 25th 8 inches of rain fell during 6 day period
    - Huge volumes of storm water where measured
- 2 cautionary advisories
  - Each advisory occurred after a brief rain event
- 3 preemptive advisories
  - Storm water conditions created turbid beachwater
  - Raining during field sampling

Aug-Sept Total P Concentrations Upper Lake Park

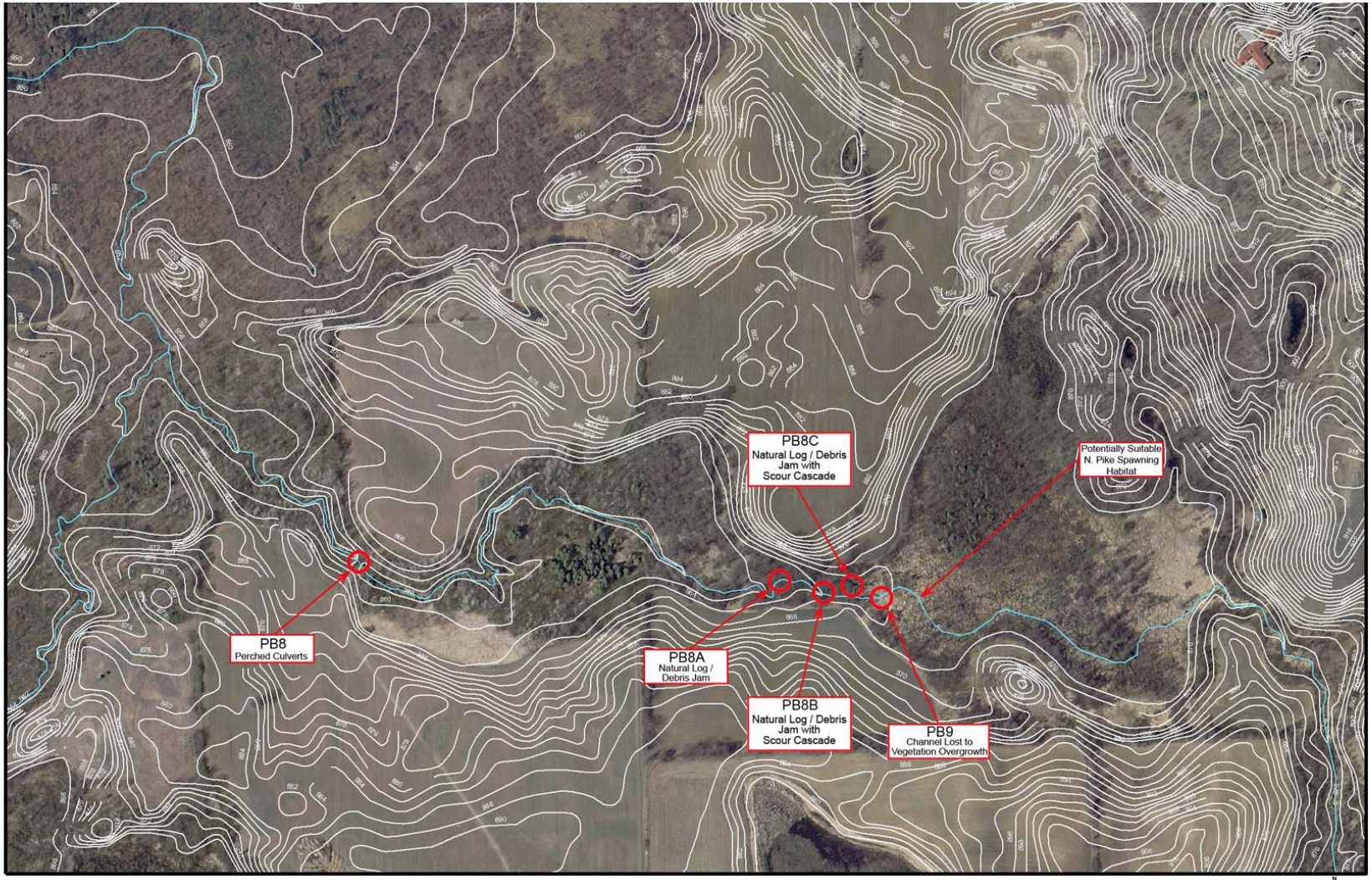


2007 Algae Impacts on Upper Lake Park



Algae Deposition on Beach (Aug 22)

FISH RECRUITMENT AND PRODUCTIVITY – CHARTER FISHING INDUSTRY & FISH IMPEDIMENTS



LAKE MICHIGAN BLUFF EROSION WORKSHOP - 2001

The Ozaukee County Land and Water Conservation Department in partnership with the Wisconsin Coastal Management Program is sponsoring a public informational session on the dynamics of Lake Michigan Bluff Erosion. The goal of forum is to provide information on:

- The dynamics of bluff erosion
- Effect of lake level fluctuations
- Mitigation alternatives & setbacks
- Shore protection measures
- Answer commonly asked questions of coastal property owners

Audience:

- Shoreline Landowners
- Public Officials
- Realtors
- Conservation Organizations
- Other Interested Individuals

When and Where:

WEDNESDAY, APRIL 11, 2001
6:30 P.M. - 8:00 P.M.
OZAUKEE COUNTY
ADMINISTRATION CENTER
AUDITORIUM
LOWER LEVEL ROOM 6
121 WEST MAIN STREET
PORT WASHINGTON
(SEE ACCOMPANYING MAP)

AGENDA

Welcome:

Andy Holschbach, Director
Ozaukee County Land and Water Conservation Department

Presenters:

The presenters, members of the inter-agency Coastal Hazards Work Group, have been working on a consistent state and local approach to address coastal erosion concerns.

Alberto Vargas, *Wisconsin Coastal Management Program*
Coastal Hazards Program Coordinator at the Wisconsin Coastal Management Program since 1996. Vargas is the Chair of the Coastal Hazards Work Group, which joins state agencies and university representatives to develop a unified view on how to deal with natural hazards in the coastal areas in the State. Vargas has also developed and implemented strategies to continue the federal funding from NOAA – Office of Ocean and Coastal Resource Management aimed at natural hazards mitigation projects in Wisconsin.

Phillip Keillor, Coastal Engineering Specialist, *UW Sea Grant Institute*
Coastal Engineering Specialist for the University of Wisconsin Sea Grant Institute. Since 1975, Keillor has helped the Wisconsin Department of Natural Resources and Coastal Management Program (WCMP) assist coastal residents and communities in coping with natural hazards of the Great Lakes. Among his recent work Keillor is the author of the Coastal Processes Manual, 2nd edition, which was published in 1998, by UW Sea Grant. Keillor is a member of the Coastal Hazards Work Group since 1989.

David Hart, GIS Specialist, *UW Sea Grant and LICGF*
Senior Outreach Specialist with the Land Information and Computer Graphics Facility at the University of Wisconsin - Madison and Coastal GIS Specialist with the University of Wisconsin Sea Grant Institute. David received the Excellence in Coastal and Marine Graduate Study Award in the 1999 Walter B. Jones and NOAA Excellence Awards for Coastal and Ocean Resource Management for his work in coastal GIS applications in Wisconsin. He is a member of the Coastal Hazards Work Group since 1994.

Alan Lulloff, *Wisconsin Department of Natural Resources*
Water Management Engineer with the Department of Natural Resources. In the past 27 years with DNR, he has worked in the wastewater, water supply, groundwater and floodplain management programs. Alan is the project manager of a DNR initiative to incorporate GIS technology with floodplain mapping. He is a member of the Coastal Hazards Work Group since 1995 and focuses specifically on developing methodology to map the Great Lakes coastal erosion hazards.

LAKE MICHIGAN BLUFF EROSION WORKSHOP - 2002

AGENDA

6:30 p.m.	Welcome and Introductions	Don Korte, Ph.D. Concordia University Associate Professor, Biology Chairman of the Science Dept.
		Alberto Vargas, Ph.D. Wisconsin Dept of Administration WI Coastal Management Program Hazards Coordinator
		Andy Holschbach Ozaukee County Land & Water Conservation Dept. Director - Land & Water Conservation Department
6:45 p.m.	Permitting / Shoreland Zoning	Steve Narveson Ozaukee County Environmental Health Dept. Zoning Administrator/ Director - Environmental Health Dept.
6:55 p.m.	Geology / Bluff Stability / Soils Hydrology / Drainage / BMPs	David M. Mickelson, Ph.D. University of Wisconsin - Madison Professor, Quaternary & Glacial Geology, Chair of Geological Engineering Program
7:25 p.m.	Forest Management / Woodland Plantings	Jim Uhrinak Green Tree-Tree Care & Consulting Consulting Arborist / Restoration Ecologist
8:10 p.m.	Prairie Plantings and Management	Mark O'Leary Applied Ecological Services, Inc. Taylor Creek Restoration Nurseries Senior Ecologist
8:55 p.m.	Panel Discussion - Questions & Answers	All Speakers
9:30 p.m.	Closing Remarks / Evaluations	Andy Holschbach Andrew Struck

CONTRIBUTING PARTNERS

GREEN TREE
TREE CARE AND CONSULTING

Applied Ecological Services, Inc.

TAYLOR CREEK

UNIVERSITY OF WISCONSIN MADISON
THE DEPARTMENT OF Geology & Geophysics
University of Wisconsin-Madison

OZAUKEE COUNTY
Countryside / Lakeside / Historic Places
ENVIRONMENTAL HEALTH DEPARTMENT

CONCORDIA UNIVERSITY WISCONSIN

SPONSORS

WISCONSIN ASSOCIATION of LAKES

WISCONSIN COASTAL MANAGEMENT PROGRAM

OZAUKEE COUNTY-LAND & WATER CONSERVATION DEPARTMENT

LAKE MICHIGAN
BLUFF EROSION AND STABILIZATION
WORKSHOP

A ROLE FOR NATIVE VEGETATION IN REDUCING SHORELINE EROSION

PHYSICAL ENVIRONMENT – COASTAL EROSION

PLAN DEVELOPMENT & OUTREACH MATERIALS

LAKE MICHIGAN

BLUFF EROSION AND STABILIZATION

A ROLE FOR NATIVE VEGETATION IN REDUCING SHORELINE EROSION

Ozaukee County

Land and Water Resource Management Plan

January 2006

WISCONSIN COASTAL MANAGEMENT PROGRAM

NOAA

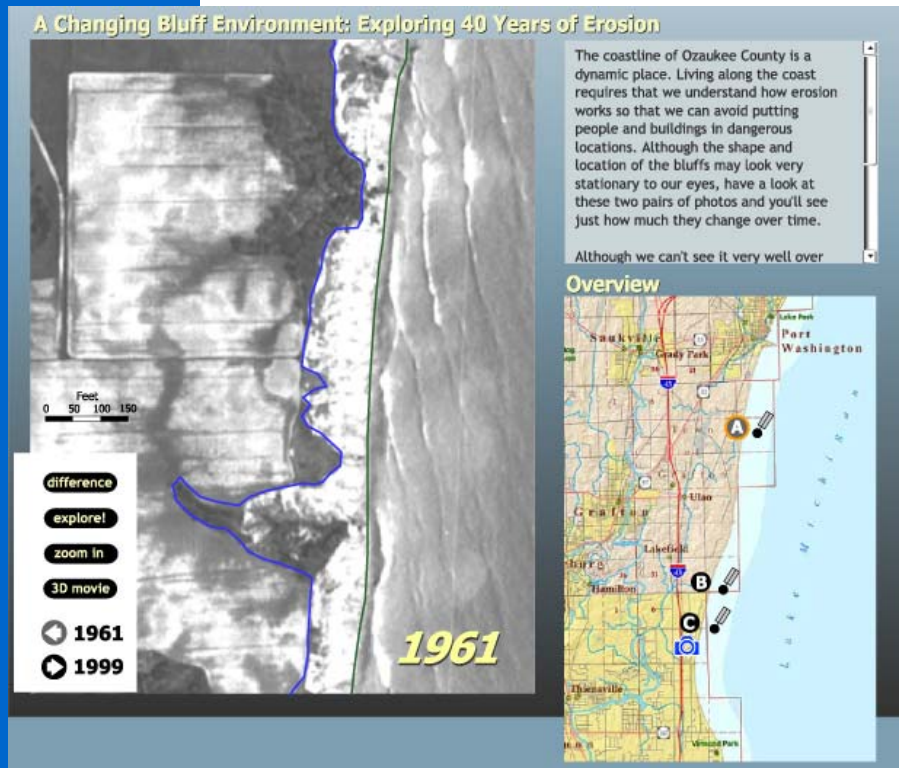
The preparation of this document was financed in part through the Wisconsin Coastal Management Program and the National Oceanic and Atmospheric Administration, of the Ocean and Coastal Resource Management, under the Coastal Zone Management Act, Grant #NA04NOS4190092

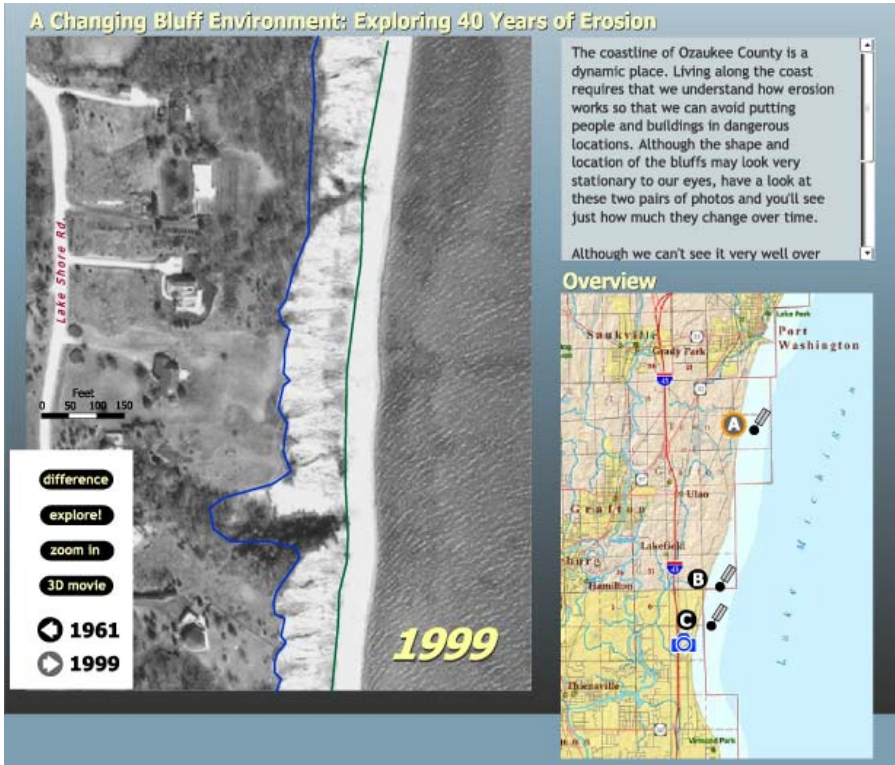
Mission Statement:

To promote sustainable and comprehensively planned growth in Ozaukee County through cost-effective technical and financial assistance, environmental education, and administration of county regulations that balance the concern for a robust local economy with: 1) the preservation, protection and enhancement of natural resources, 2) an increased awareness for environmental protection and regulation, and 3) the implementation of land and water conservation practices that provide the public with an improved quality of life in Ozaukee County.

PHYSICAL ENVIRONMENT – COASTAL EROSION

GIS COASTAL VISUALIZATION WEBSITE





CLIMATE CHANGE IN THE GREAT LAKES REGION – A PUBLIC DISCUSSION

www.seagrant.wisc.edu/ClimateChange

Climate Change in the Great Lakes Region
Starting a Public Discussion

UW Sea Grant Institute • Wisconsin Coastal Management Program • NOAA • Ozaukee County

Global warming is an undeniable reality, according to the latest (2007) report from the Intergovernmental Panel on Climate Change (IPCC), an international group of scientists convened by the United Nations. The evidence is clear and noticeable: a rising average global air temperature, widespread melting of glaciers and polar ice, and rising mean sea levels worldwide. The report sounds the alarm that the Earth is warming, and that major components of our climate system are already responding to that warming.

What will global warming mean for our region? The "Climate Change in the Great Lakes Region" seminar series provides a forum to begin this important discussion. Over the next several months, experts will speak at sites throughout Wisconsin to discuss what is known, what is predicted and what can be done to adapt. The series begins with a keynote presentation by Dr. Kevin Trenberth, a leading climate researcher from the National Center for Atmospheric Research and one of the authors of the current IPCC report. Subsequent talks will highlight how climate change could affect our property, water resources, fisheries, and public health.

2007 SEMINAR SERIES:

MARCH 13
THOMAS E. CROLEY II
Research Hydrologist, Great Lakes Environmental Research Laboratory
Great Lakes Climate Change Hydrologic Impact Assessment
Green Bay, Wisconsin

KEN POTTER
Professor of Civil and Environmental Engineering, UW-Madison
Adapting Stormwater Management to Climate Change
Green Bay, Wisconsin

APRIL 23
KEVIN TRENBERTH
Senior Scientist, National Center for Atmospheric Research
KEYNOTE PRESENTATION:
Global Warming Is Unequivocal
Morgridge Auditorium, Grainger Hall
Madison, Wisconsin

JUNE 7 & 11
JOHN MAGNUSON
Emeritus Professor of Zoology and Limnology, UW-Madison
Climate Change and the Waters of Wisconsin
Superior and Milwaukee, Wisconsin

AUGUST 8
TIM ASPLUND
Water Resources Specialist, Wisconsin Department of Natural Resources
Climate Change and Wisconsin's Lakes and Groundwater
Ashland, Wisconsin

AUGUST 15
PHILIP KEILLOR
Coastal Engineering Specialist (Retired)
UW-Madison Sea Grant Institute
How Climate Change May Affect Coastal Property Owners
Mequon, Wisconsin

SEPTEMBER 12
JONATHAN PATZ
Associate Professor of Environmental Studies and Population Health Sciences, UW-Madison
Climate Change and Public Health Concerns
Madison, Wisconsin

SEPTEMBER 24
BRIAN SHUTER
Research Scientist, Ontario Ministry of Natural Resources and Adjunct Professor of Zoology, University of Toronto
Climate Change and Fisheries
Cleveland, Wisconsin

Sea Grant
Wisconsin Coastal Management Program
Ozaukee County

Climate Change in the Great Lakes Region
Starting a Public Discussion

UW Sea Grant Institute • Wisconsin Coastal Management Program • NOAA • Ozaukee County

Climate Change Coming to the Coasts of Wisconsin: How It May Affect Coastal Communities and Property Owners

Philip Keillor
Coastal Engineering Specialist (Retired)
UW-Madison Sea Grant Institute

7 p.m. • Wednesday, August 15
Todd Wehr Auditorium
Concordia University Wisconsin
12800 North Lake Shore Drive

This presentation is directed principally to private landowners and public managers of coastal property along Wisconsin's Lake Michigan shoreline and secondarily to those who have some other professional or personal interest in protecting the state's natural coastal resources and the billions of dollars invested in coastal property.

Philip Keillor helped shoreline communities manage coastal hazards throughout his 30-year career as the UW-Madison Sea Grant Institute's Coastal Engineering Specialist. After retiring in 2004, he has taken a keen interest in climate change studies and how future scenarios could affect coastal property.

Keillor's presentation will cover: (1) evidence of climate change in Wisconsin, the Great Lakes Region, and beyond; (2) plausible scenarios of future climate change in the state and Great Lakes Region and uncertainties about these scenarios; (3) possibilities of climatic "surprises" and dangerous climate change; (4) expert opinion by others on how the stability of coastal slopes is expected to be affected by specific, possible climate changes, and (5) expected lake level responses to climate change.

Keillor will address the present situation of the coasts and will propose ways to increase the short-term and long-range resiliency of coastal lands and coastal investments to a changing climate. He will also invite the audience to offer their input.

Philip Keillor is a former coastal engineering specialist with the UW Sea Grant Institute. Throughout his career, he has helped Wisconsin's governments, coastal residents, and communities cope with natural hazards, harbor dock and dredging problems, and other coastal issues. In 2005 and 2006, Keillor worked on a NOAA-funded contract with the Association of State Floodplain managers to apply its "No Adverse Impacts" floodplain management practice to addressing of coastal hazards on all U.S. coasts. He also led a Great Lakes-wide effort to develop new guidance on shore protection for coastal property owners. Funded by the U.S. Army Corps of Engineers, the resulting 2003 publication, *Living on the Coast: Protecting Investments in Shore Property on the Great Lakes*, was the Corps' first publication on the subject in a quarter century. In 2004, the Sea Grant Extension Assembly awarded Keillor the William Z. Wick Visionary Career Leadership Award for his work on coastal hazards.

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